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RESEARCHUPDATE

Research Update is published by the Butler Center for Research to share significant scientific findings from the field of addiction treatment research.

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Genetic Factors in Alcohol Dependence

Scientists have been working for years to understand the genetic component of alcohol dependence. Humans have 23 pairs of chromosomes that include thousands of genes. Areas on several chromosomes have been implicated in alcohol dependence but no specific gene has been found.[1] Finding a specific gene is not likely given the complexity of alcoholism and the way in which multiple genes interact.[2] Research on adoptees and twins, alcohol sensitivity, and neurobiology has shed light on the role of genetic factors in the transmission of this disease.

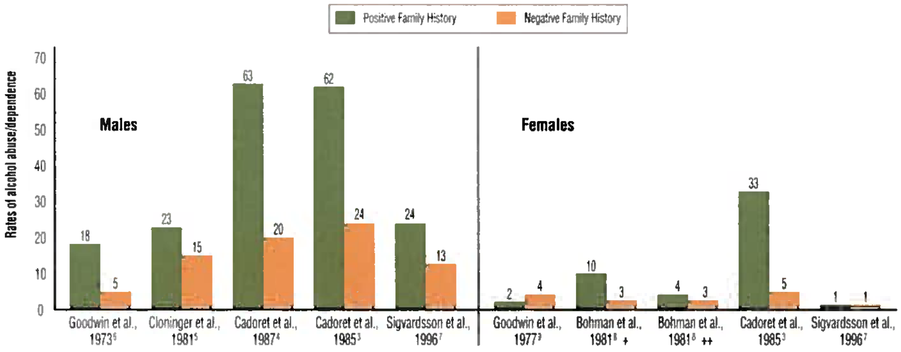
Adoption and Twin Studies

Because relatives living together share environmental factors (e.g. social economic status, parenting style), clustering of alcoholism in a family may reflect the impact of a common environment rather than a biological transmission of the disease. Studies of adopted children and twins help researchers differentiate between the role of genetics and the environment. Several studies have compared rates of alcohol abuse and dependence among adopted-out children of alcohol dependent parents and adopted-out children of non-dependent parents[3, 4, 5, 6, 7] (see Figure 1). Overall, the data reveal a significantly higher rate of alcohol abuse and dependency among biological sons of dependent parents adopted into other homes as compared to adopted-out sons of non-dependent parents. Among females, the data are inconsistent.[3, 7, 8, 9]

Twin studies provide another useful method for estimating the role of genetics by calculating concordance rates. Concordance rates can vary between 0 (no relationship) and 1.00 (perfect relationship). Several studies have found concordance rates are higher among identical twins than fraternal twins, most consistently among men.[10, 11, 12, 13, 14, 15]

Heritability refers to the percentage of alcoholism vulnerability that is attributable to genetics. Heritability estimates suggest genetic factors account for approximately 40-60% of the risk for the development of alcohol abuse or dependence.[11, 12, 13, 14]

Figure 1:
Rates of Alcohol abuse/dependence among adoptees with or without a family history of abuse/dependence



Note: Values are rounded to the nearest whole number.

+ Adoptees with biological family history of maternal alcohol abuse/dependence only.
++ Adoptees with biological family history of paternal alcohol abuse/dependence only.

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THE HAZELDEN EXPERIENCE

Hazelden is committed to advancing research on the development and transmission of alcohol and drug dependence. In the late 1980s, Hazelden staff collaborated with researchers investigating concordance rates of alcohol dependence among twins.[10, 11] In 1999, Hazelden staff supported the recruitment efforts of the University of California—San Francisco in their study of familial transmission in alcoholism.

CONTROVERSIES & QUESTIONS

Controversy: *What if specific genes for alcohol dependence are identified? Will health insurers raise rates or deny care for those found to be genetically at risk for the disease?*

Response: In reaction to these potential abuses of genetic information, 42 states have adopted laws against genetic discrimination on the part of health insurers and 21 states have laws targeting genetic discrimination by employers.[21]

Question: *Is there a genetic basis for other types of drug dependence?*

Response: The research findings are similar for other drugs. For example, one study of drug dependence found higher concordance rates for genetic factors for identical male twins compared to non-identical twins whereas no differences were found for environmental factors.[22]

HOW TO USE THIS INFORMATION

- **Educators:** Advance the idea that alcohol dependence is a complex disease, has no simple explanation, and appears to develop as a result of both genetic and environmental factors.
- **Policy:** Advocate for continued research into the genetic bases of this disease and promote legislation that prohibits discrimination on the basis of genetic testing.
- **Care Providers:** While genetics do not account for all of the development of alcohol dependence, certain factors related to this disease are transmitted among biological relatives. Work toward early identification with the hope of preventing the development of this devastating disease.

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Genetic Factors in Alcohol Dependence

Alcohol Sensitivity

There are genetic differences in the way people metabolize alcohol. Some lack an important enzyme. This deficiency acts like a built-in form of Antabuse and typically causes flushing and illness in reaction to alcohol. The responsible gene for this deficiency, designated ALDH2-2, is located on chromosome 12 and is common among those with Japanese or Chinese ancestry.[2, 16]

While increased alcohol sensitivity may provide a protective function, reduced alcohol sensitivity appears to be related to the development of alcoholism. People with low alcohol sensitivity do not feel the effects of alcohol as quickly as others. In one study, 40% of men with an alcohol dependent father had lower biological and subjective levels of reaction to alcohol compared to 10% of men without an alcohol-dependent parent, even though they had the same blood alcohol level.[17] Several years later, 56% of the sons with lower alcohol sensitivity became alcohol dependent whereas only 15% of those with high sensitivity levels developed this disease.

Neurobiological Research

Begleiter and colleagues have completed a variety of brain-wave studies.[18, 19] They found that alcohol dependent individuals are more likely to have lower levels of brain wave response to certain visual stimuli compared to non-dependent individuals. This difference is known as the P3 deficit and persists in dependent subjects who have been abstinent for up to 10 years.[18, 20] Although the P3 deficit has been found in both dependent men and women, it appears to be more pronounced among men with family histories of dependence.[19]

Summary

Evidence exists for a genetic contribution to alcoholism. However, genetics only account for 40-60% of the variance in alcohol dependence. Clearly, alcohol dependence is a complex problem that involves interplay between genetic and environmental factors.[2, 18]

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The Butler Center for Research informs and improves recovery services and produces research that benefits the field of addiction treatment. We are dedicated to conducting clinical research, collaborating with external researchers, and communicating scientific findings.

Patricia Owen, Ph.D., Director

If you have questions, or would like to request copies of Research Update, please call 800-257-7800 ext. 4405, email butlerresearch@hazelden.org, or write BC 4, P.O. Box 11, Center City, MN 55012-0011.

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